



# Gateway™ ATR Electrically Heated Trough Top Plate

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## *User Manual*



2I-11155-16

## List of Safety Symbols

| Safety Symbol   | Meaning  |
|---|--|
|  | General Caution.<br>(Reference ISO 7000-0434B, 2004-01)      |
|  | Caution – Hot Surface.<br>Reference IEC 60417-5041, 2002-10) |
|  | Caution – Possibility of Electric Shock                      |
|  | Indoor Use Only  |

## Electrical Safety



**Warning:** The temperature controller supplied with the this accessory is Class 1 (earthed) construction and must be connected to an earthed mains socket outlet.



**Warning:** Disconnect the mains from the temperature controller before cleaning. Clean only with a soft cloth, lightly moistened with water.

# Gateway™ ATR Electrically Heated Trough Top Plate

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*User Manual*

# *Gateway™ ATR Electrically Heated Trough Top Plate P/N GS11155*

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## 1. Introduction

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Thank you for purchasing a Specac Product.

This user instruction manual for the Gateway™ ATR Electrically Heated Trough Top Plate P/N GS11155 is to be used in conjunction with the user instruction manual provided for the Gateway™ 6 Reflection ATR Accessory against P/N GS11165 (2I-11165-4). Understanding of the Gateway™ ATR Accessory itself helps in usage of any alternative ATR Top Plates that are compatible with this ATR system.

The Gateway™ ATR Electrically Heated Trough Top Plate P/N GS11155 is an alternative Top Plate that can be used on the optical unit (P/N GS11170) of the Gateway™ ATR Accessory. The Gateway™ ATR Accessory supplied as standard for a kit of parts under P/N GS11165, provides for an optical unit (GS11170), a trough top plate assembly fitted with a 45° ZnSe crystal (GS11166), a flat top plate assembly fitted with a 45° ZnSe crystal (GS11133) and a clamp assembly (GS11171). (See user instruction manual 2I-11165-3).

**Note:** *Any Gateway™ ATR Top Plate assembly can also be used on older Benchmark™ ATR optical units, P/N's GS11160, GS11110 and GS11180.*

Using the Gateway™ ATR Electrically Heated Trough Top Plate in conjunction with any of the above optical unit systems, a liquid sample can be held static over a 6 Reflection event ATR crystal to be studied from ambient up to 200°C temperatures, the temperature being set in 1°C steps over the entire range. Chemical interactions for the mixing of sample species at varying temperatures may also be monitored. (e.g. a solid sample can be deposited onto the ATR crystal and a fluid can be placed over the sample to observe any changes spectroscopically.)

Power is applied to raise the temperature of the Top Plate assembly by use of a dedicated 4000 Series™ Temperature Controller. A separate user instruction manual is supplied for use and understanding of the controller to operate the Heated Top Plate assembly.

## User Manual

Usually, a liquid sample to be analysed is just simply placed to cover over the ATR crystal analysis area of the Trough Top Plate assembly. However, thin polymer films or semi-solid type samples can also be analysed spectroscopically if the film is cut to the approximate size of the crystal surface area and the Gateway™ ATR clamp assembly mechanism is employed. A PTFE pressure pad piece is supplied to enable this type of sampling to be carried out.

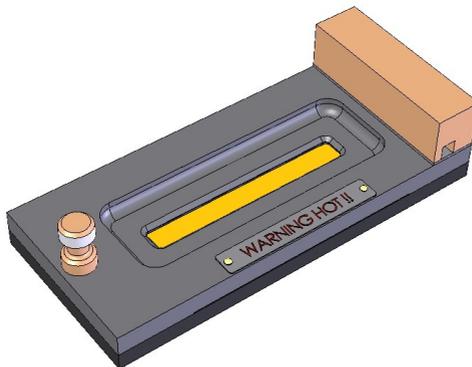
The Gateway™ ATR Electrically Heated Trough Top Plate has been designed with the capability to remove the ATR crystal for thorough cleaning or using a replacement ATR crystal material in the Top Plate if desired. Any of the crystal materials usable with the Gateway™ ATR system – ZnSe, germanium or silicon – can be placed into the Gateway™ ATR Electrically Heated Trough Top Plate, although germanium loses its spectral IR transmission capability with a progressive rise in temperature, becoming completely opaque at temperatures of circa 100°C and above.

As a standard offering for P/N GS11155, a 45° angle ZnSe crystal (P/N GS11145) is fitted. The ATR crystal options are:

P/N GS11145 - Gateway™ ZnSe crystal, 45° angle.

P/N GS11146 - Gateway™ Silicon crystal, 45° angle.

P/N GS11147 - Gateway™ Germanium crystal, 45° angle.



**Fig 1. Gateway™ ATR Electrically Heated Trough Top Plate**

## 2. Safety Considerations

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With use of any spectroscopic accessory that involves the study of a wide range of chemical samples, the associated risk in handling may mostly be attributed to the specific sample type to be handled itself. As far as it possible you should follow a procedure for safe handling and containment of the type of sample to be used.

With respect to safety of use specifically to the Gateway™ ATR Accessory, this uses different crystal materials for the ATR crystal Trough, Flat and Flow Through Top Plate assemblies where a sample is brought into contact for analytical spectroscopic study. As standard, Zinc Selenide (ZnSe), germanium (Ge) and Silicon (Si) are the three crystal materials of choice that can be used.



**Caution:** *Out of these three different crystal types, ZnSe is the most potentially hazardous material with respect to toxicity risk in use and handling.*

Both Ge and Si crystal materials can be considered relatively safe to use, although Ge may be harmful to the body if it is ingested in significant quantity. The general rule when working with **any** crystal material (and sample) **is to always wear gloves and safety gear** (e.g. safety spectacles) when handling to obviate the risk of contact with the skin.

Provided with each ATR crystal version of top plate assembly is a window material safety data sheet for the crystal material itself that can be consulted for safe handling. A copy of each of these datasheets can also be found in the Gateway™ ATR instruction manual (2I-11165-4) in the **Notes on Cleaning** Section found on pages 42, 43 and 44.

### General Operational Safety Use



**Caution:** Always follow local laboratory safety protocols and procedures when using potential toxic or flammable substances with this equipment. The equipment is intended for use by suitably trained personnel only.



**Caution:** No user serviceable parts within the temperature controller supplied, contact the manufacturer or approved service agent for advice if the product is not functioning correctly or is visibly damaged.



**Caution:** If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired



**Warning:** Risk of burns when operated at high temperatures on accessible parts surrounding the heated assembly.

## End of Lifetime Equipment Use



If any parts have reached their limit of lifetime and need to be replaced, use appropriate WEEE and other local regulations for the safe disposal of electrical equipment and toxic chemicals.



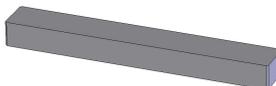
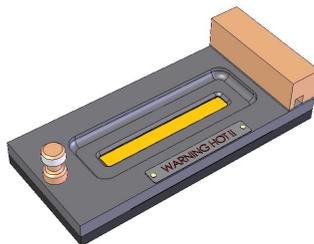
### 3. Unpacking and Checklist

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The Gateway™ ATR Electrically Heated Trough Top Plate and its dedicated 4000 Series Temperature Controller are supplied packed in a black plastic carry case and cardboard box respectively.

The carry case contains the following:

- Electrically Heated Trough Top Plate with Zinc Selenide crystal (or as specified from germanium and silicon options) and integral power/thermocouple connectivity cable.
- ATR spectrum of the crystal as fitted to the Top Plate assembly to show its background throughput.
- PTFE pressure bar.
- Plastic spatula.
- Allen Key (2.5mm A/F)



The cardboard box contains the following:

- 4000 Series Temperature Controller dedicated for control of the Gateway™ ATR Electrically Heated Top Plate.
- Appropriate mains power cable.
- Instruction manual for the 4000 Series Temperature Controller.



Remove the items carefully from their packaging in preparation for installation and use.

## 4. Alignment of the Gateway™ ATR Electrically Heated Trough Top Plate

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The Gateway™ ATR Electrically Heated Trough Top Plate is to be installed onto the optical unit (GS11170) of the Gateway™ ATR Accessory for operation in the study of static liquids or semi-solid samples and thin films over the temperature conditions from ambient to 200°C. This Trough Top Plate should be optimised for its energy light throughput from a particular alignment of the mirrors on the optical when installed for use.

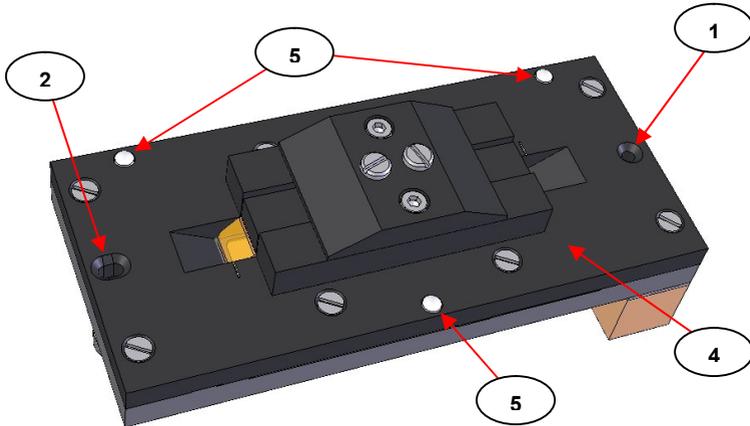
If the Gateway™ ATR Accessory (as the Kit GS11165) is available for use, please follow the instruction manual supplied (21-11165-4) for the alignment procedure to optimize the light energy throughput of the ATR system on your particular spectrometer using either the Trough Top Plate (GS11166) or Flat Top Plate (GS11133) assembly as supplied. The input and output mirror settings for their rotation and tilt angles will be established on the optical unit (GS11170) from the alignment procedure using either of these two Top Plates.

When subsequently placing the Electrically Heated Trough Top Plate onto the optical unit as a replacement for either the Trough (GS11166) or Flat (GS11133) Top Plate assembly, a signal throughput will be registered, but it is possible the mirrors in the optical unit may require slight re-adjustment for an optimum throughput to be established in use of this alternative Trough Top Plate. Follow the alignment procedure with the Electrically Heated Trough Top Plate in position to obtain the best throughput energy signal for the spectrometers system.

**Note:** *If just the Gateway™ optical unit (GS11170) and an Electrically Heated Trough Top Plate are available to use, unless the optical unit has been pre-aligned to register some energy throughput with a Top Plate in position, then it may be difficult to gain an optimum alignment using the FTIR spectrometer systems energy source and detection system. A rough pre-alignment is to be established with the optical unit and Electrically Heated Trough Top Plate in position using a visible light source such as the Laser Alignment Accessory (P/N GS24500).*

## Fitting the Gateway™ ATR Electrically Heated Trough Top Plate

The Gateway™ ATR Electrically Heated Trough Top Plate fits onto the top of the Gateway optical unit via alignment of the round hole (1) and slot hole (2) on the underside of the Top Plate over the two fixing location pins (3) on the optical unit. (See Fig 2 and Fig 3.)

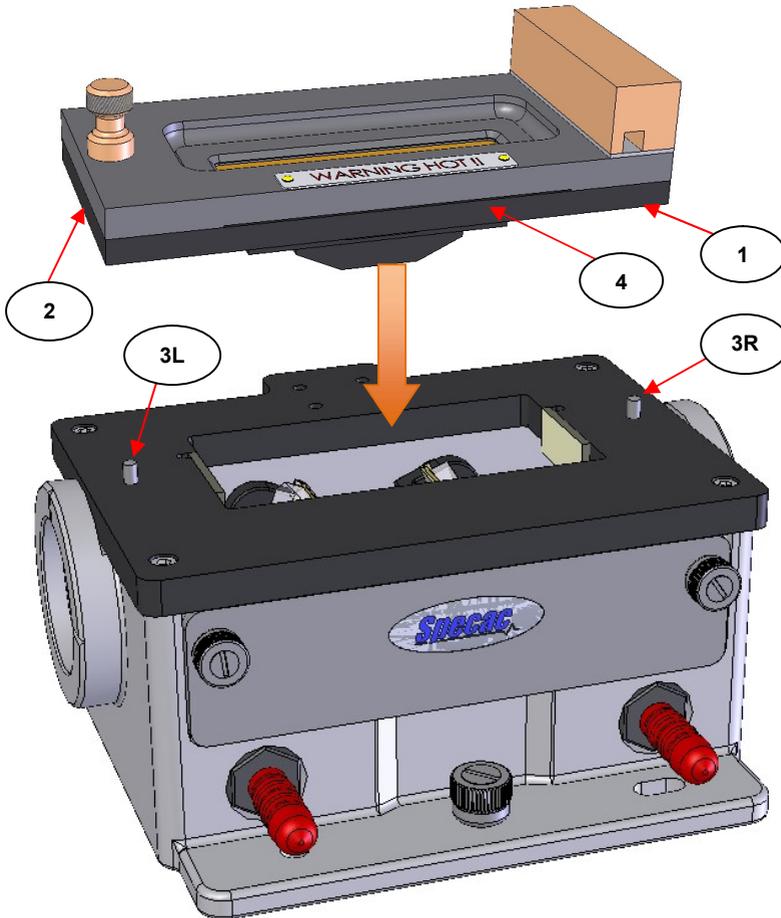


**Fig 2. Round and Slot Location Holes on Underside of Gateway™ ATR Electrically Heated Trough Top Plate**

The Gateway™ ATR Electrically Heated Trough Top Plate is fitted and positioned the correct way around on the optical unit when the round hole (1) is placed over the **right side** location pin (3R) and the slot hole (2) is placed over the **left side** location pin (3L) as viewed from the front of the optical unit. The main body plate (4) of the Top Plate assembly should be resting on its three PTFE stand-off feet (5) onto the top surface of the optical unit when properly located.

**Note:** *To maintain a correct optical alignment for consistency of optical throughput energy of the Gateway™ ATR Electrically Heated Trough Top Plate, it should always be placed onto the optical unit the same way around after removal for cleaning or crystal replacement etc, with the round (1) and slot (2) holes fitting over their correct and respective fixing location pins (3R) and (3L).*

**Important:** Care must also be taken to see that from installation there is no unnecessary stress or strain applied to the integrally fitted power/thermocouple cable, which could cause damage to the thermocouple. Avoid sharp bends of this cable at the end attached to the Heated Trough Plate.



**Fig 3. Fitting of Gateway™ ATR Electrically Heated Trough Top Plate to the Gateway™ Optical Unit**

## 5. Analysing Different Sample Types

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When the Gateway™ ATR Electrically Heated Trough Top Plate has been correctly installed onto the optical unit and aligned, then its integral power and thermocouple cable assembly with the six-way bayonet plug of the Top Plate assembly is to be connected to its appropriate socket at the rear of the 4000 Series Temperature Controller. The bayonet plug is push fitted and turned to click into the Controller's socket connection.

**Note:** *Please refer to the instruction manual supplied for the 4000 Series Controller to make the connection and how to heat and control the temperature to the Electrically Heated Trough Top Plate assembly.*

In operation for collection of a background spectrum and then a sample spectrum (see Spectral Collection Using the Gateway™ ATR Accessory from the instruction manual 2I-11165-3), ideally the temperature conditions for both spectral acquisitions should be the same. The parameters of operation for the Electrically Heated Trough Top Plate have been specifically set on its 4000 Series Controller to allow for a **maximum** temperature rate rise of 10°C per minute. Any higher rate rise risks introducing thermal shock to the ATR crystal (6) in the Top Plate assembly and causing damage. For the parameter listing set on the supplied 4000 Series Controller, please refer to section 7), pages 25 and 26 of this user instruction manual.

### Liquid Sampling

Liquids can be poured onto the crystal (6) of the Gateway™ ATR Electrically Heated Trough Top Plate or introduced by the use of a pasteur pipette.

The liquid should cover the entire ATR crystal (6) surface where the sample is being heated. It is important that a sufficient volume of sample is applied so that the crystal (6) is not left exposed during any spectral measurement, if there is any vaporization of the sample because of an elevation in the temperature above ambient conditions.

As much of a liquid sample should be removed from the crystal (6) area with a pasteur pipette when the Heated Trough Top Plate assembly is cool to touch if any elevated temperature measurements have been taken. It is recommended that the Heated Trough Top Plate is also removed away from the optical unit to a safe area for cleaning before introducing the next sample or after use. This prevents potential accidental contamination of the optical unit parts and the sample compartment area of the spectrometer.

**Note:** *Removal of the Top Plate assembly from the optical unit to clean in a safe working area may also require disconnection of its power and thermocouple cable from the 4000 Series Controller.*

If the liquid sample solidifies against the ATR crystal (6) when the Top Plate assembly cools from an elevated temperature measurement, it may be easier to remove most of the sample when hot, by very carefully using the pipette and wiping the remainder of any sample away from the ATR crystal (6) with a soft lens cleaning tissues while cooling. Remove the last traces of the sample when the Top Plate assembly has cooled sufficiently to handle by using fresh tissues soaked in a suitable solvent.



**Warning:** *Do not remove the Heated Trough Top Plate for cleaning when hot as it can cause serious burns.*

## Paste Samples

Apply the paste lightly to cover the ATR crystal (6) surface completely using the plastic spatula as supplied.

Similar to liquid sample handling, remove the sample by wiping clean using a soft lens cleaning tissues when the top plate has cooled sufficiently. Remove the last traces of the sample by using fresh tissues soaked in a suitable solvent.

If the paste sample solidifies against the ATR crystal (6) when the Top Plate assembly cools from an elevated temperature measurement, it may be easier to remove most of the sample when hot, by very

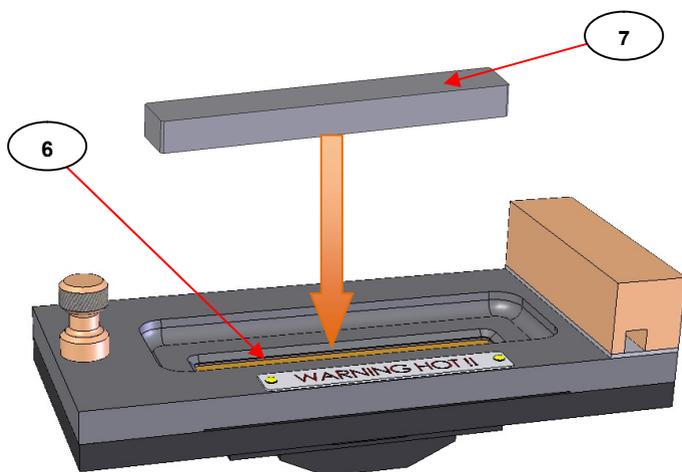
carefully using soft lens cleaning tissues to wipe the sample clear of the crystal (6) while cooling. Remove the last traces of the sample when the Top Plate assembly has cooled sufficiently to handle by using fresh tissues soaked in a suitable solvent.



**Warning:** *Do not remove the Heated Trough Top Plate for cleaning when hot as it can cause serious burns.*

### Semi-Solid Samples (Films)

Although the Electrically Heated Trough Top Plate has been specifically designed for the ATR measurement of liquid sample types at elevated temperatures up to 200°C, flexible semi-solid, film type samples can be analysed by use of this Top Plate with the supplied PTFE pressure bar (7) and employment of the Gateway™ ATR Clamp Assembly fitted to the optical unit. (See Fig 4.)



**Fig 4. PTFE Pressure Bar Used With Electrically Heated Trough Top Plate**

To analyse a semi-solid sample such as a thin film, the film sample must be prepared by cutting to size to cover over the entire surface of the ATR crystal (6) in the recess of the trough area. The PTFE pressure bar (7) is then very carefully placed over the film surface on top of the crystal (6). The PTFE pressure bar (7) allows for a sufficient height above the surrounding recessed trough area to transfer the force that is to be applied from use of the clamp assembly. Please refer to installation and operation of the clamp assembly when on the optical unit from the Gateway™ ATR instruction manual 2I-11165-3, pages 9 to 12.

**Exercise great care when sampling for semi-solid types.** Apply a load from the clamp assembly to give sufficient sample contact to register an ATR spectrum for the sample. Any temperature can be selected from ambient to 200°C to measure for the sample, but be careful if the film sample is subject to melting, burning or charring at elevated temperatures in case of potential subsequent damage to the Gateway™ ATR Top Plate components and crystal (6).

**Note:** *The ATR crystal (6) is held liquid tight against an upper Kalrez gasket seal (8) in the Gateway™ ATR Electrically Heated Trough Top Plate by means of spring tensioning screws (9) in a lower clamp pressure plate assembly (10). Do not apply too much pressure from the clamp assembly to the crystal (6) as this could force the crystal (6) to be detached from the upper Kalrez gasket seal (8) in the main body plate (4) of the Top Plate assembly. This event would result in loss of any applied heat to the sample and possible leakage of the entire Top Plate assembly when subsequently used for any liquid samplings.*

Similar to liquid sample handling, after analysis remove the film sample from the ATR crystal (6) and wipe clean using a soft lens cleaning tissues when the top plate has cooled sufficiently, if elevated temperatures have been used in any sample measurements. Remove any last traces of the sample from the crystal (6) by using fresh tissues soaked in a suitable solvent.

## 6. ATR Crystal Removal and Replacement

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The design of the Gateway™ ATR Electrically Heated Trough Top Plate allows for the ATR crystal (6) to be removable for easier cleaning or if damage occurs and the crystal needs to be replaced.

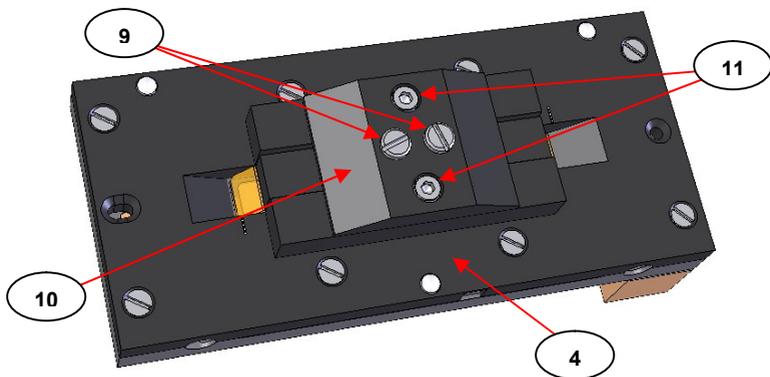
### Crystal Removal from the Heated Trough Top Plate

If it is necessary to remove the crystal (7) for thorough cleaning of the Top Plate assembly of parts or to replace any damaged parts etc, the following procedure should be adopted.

**Note:** *It is normally easier to work on the Top Plate assembly having disconnected the power and thermocouple cable from the 4000 Series Controller.*

**Important:** *For safety precautions wear gloves when carrying out the following procedure.*

- 1) Lay the Top Plate assembly on to a clean workspace area and proceed to remove the two M3 x 8mm cap head screws (11) from the lower clamp pressure plate assembly (10) on the underside of the Top Plate assembly using the 2.5mm A/F Allen key supplied. Turn the screws (11) anticlockwise to remove. (See Fig 5.)

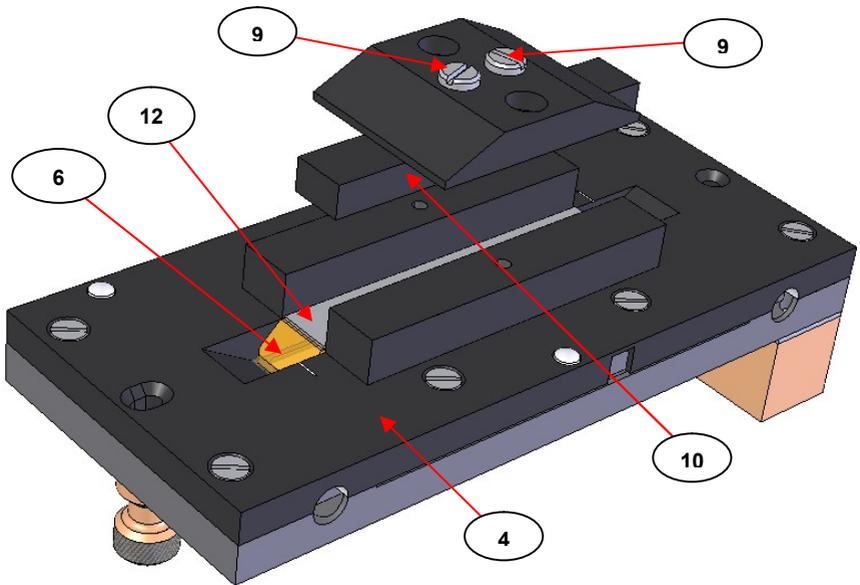


**Fig 5. Underside of Heated Trough Top Plate Assembly**

**Note:** *Do not touch the two slot head tensioning screws (9) as these hold the components of the lower clamp plate assembly (10) together for containment of the internal springs.*

2) Between the underside of the lower clamp plate assembly (10) and the ATR crystal (6) there is a protective lead pad (12). Carefully remove the lower clamp plate assembly (10) away to gain access to the lead pad (12). (See Fig 6.) The lead pad (12) may be stuck close to the underside of the crystal (6) and so it needs to be removed very carefully away from the crystal.

**Note:** *The lead pad (12) will be needed in any re-assembly after cleaning of parts or if replacing with a new crystal (6).*



**Fig 6. Lead Pad on Underside of ATR Crystal with Removal of Lower Clamp Pressure Plate Assembly**

3) If the lead pad (12) has adhered to the crystal (6), then it may be easier to remove it carefully away from the crystal when the crystal

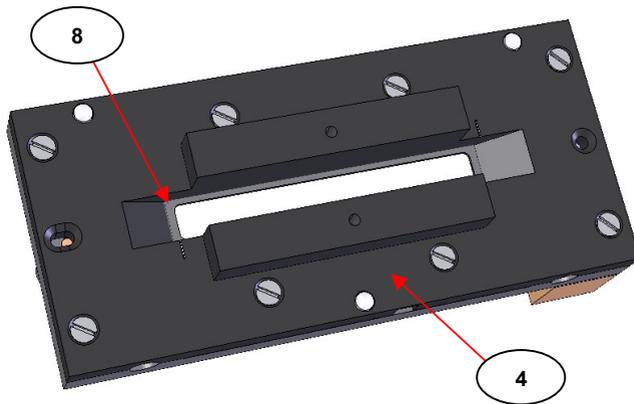
(6) itself has been removed from its centralised position in its recess of the main body plate (4). Therefore, support the crystal (6) and the lead pad (12), with one hand and turn over the Top Plate assembly so that the crystal (6) can fall out to drop into the palm of your hand. If the crystal (6) is also stuck in the main body plate (4) because of good sealing to the Kalrez gasket (8) on the top (sampling) surface of the crystal (6), then put a soft pad or tissue on the work bench area and lay the Top Plate assembly onto it the same way up as it would be used when fitted to the optical unit. Try to loosen the crystal (6) away from the Kalrez gasket (8) seal by exerting a small pressure on either ends of the top of the crystal (6) from inside the trough area and pushing down from above. Do not press too hard in case the crystal (6) breaks. (ZnSe, in particular, is a hard, but brittle crystal material.) If the crystal is stubborn to movement try to lubricate the internal trough and Kalrez gasket (8) area by use of some solvent (e.g. methanol) covering the top surface of the crystal (6) whilst exerting the gentle pressure.

When the crystal (6) and the lead pad (12) have been removed, it may now be easier to separate the lead pad (12) from the crystal. If the crystals (6) top sampling surface looks OK and can be cleaned carefully, then it may not be necessary to remove the lead pad (12) away for further cleaning prior to re-assembly and use. However, if the lead pad (12) is to be removed, it may be necessary to immerse the whole crystal (6) and lead pad (12) assembly in a beaker of water or methanol solvent and apply a gentle “sonication cleaning” of the items. The action of the sonic agitation of the solvent may help to loosen the lead pad (12) away from the crystal such that when the items are removed from the solvent they can be easily and safely separated without any damage to the lead pad (12) or crystal (6) parts.

Clean the ATR crystal (6) by following the Notes on Cleaning instructions on page 20.

### **Cleaning the Kalrez Gasket Seal**

When the ATR crystal (6) has been removed from the Top Plate assembly, access can be gained to the Kalrez gasket seal (8) for cleaning if necessary. (See Fig 7.)



**Fig 7. Kalrez Gasket Seal in the Gateway™ ATR Electrically Heated Trough Top Plate**

If a new Kalrez gasket seal (8) is needed, this is specially cut to fit from Kalrez sheet material. The procedure is best done by Specac as further dis-assembly of the Top Plate is required to replace a new Kalrez gasket (8) seal and for re-fitting of a new ATR crystal (6) into position within the Electrically Heated Trough Top Plate assembly.

**Warning:** *Further dis-assembly of the Top Plate for the Kalrez gasket (8) replacement exposes electrical components which should not be touched other than by qualified electrical personnel.*

If a new Kalrez gasket (8) is ever required, please contact Specac at [techsupport@specac.co.uk](mailto:techsupport@specac.co.uk) to arrange for return of the item to Specac to carry out the service.

If however, after removal of the crystal (6) the Kalrez gasket (8) is in good condition and only requires cleaning, then suitable solvents such as water, methanol or acetone may be used to moisten a soft lens type cleaning tissue or cotton bud to wipe around the gasket surfaces.

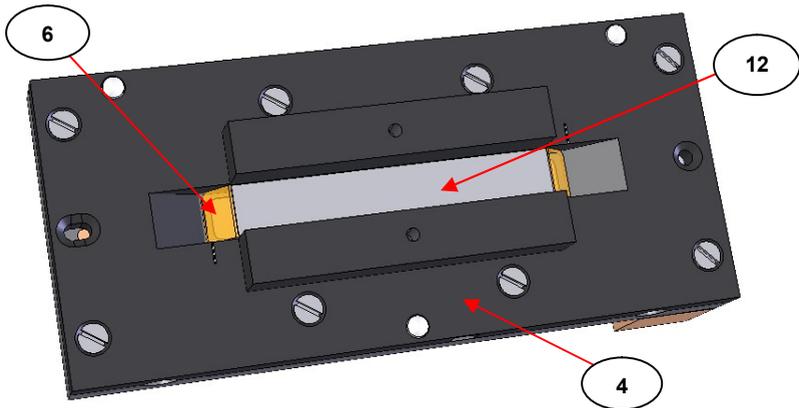
**Note:** *Specac recommend that with removal or replacement of the crystal (6), fitting a new Kalrez gasket (8) is the preferred option.*

## Replacing the Crystal in the Top Plate Assembly

- 1) Having cleaned all of the parts sufficiently and whether installing a new or cleaned crystal (6), re-assemble the Gateway™ Electrically Heated Trough Top Plate first by carefully inserting the ATR crystal (6) into the recess channel of the main body plate (4) with the longer top surface of the crystal pressing against the Kalrez gasket (8) and the angled faces of the crystal (6) pointing upwards. Ensure that the ends of the crystal (6) line up with, or are equidistant from, the alignment marks on either side of the recess channel in the main body plate (4) so that the crystal (6) is sitting flat in the recess and not resting on an inclined chamfer face.

**Note:** *If the crystal (6) is not placed flat and centrally against the Kalrez gasket (8) it will break when being pressure sealed from repositioning and screw tightening of the lower clamp pressure plate assembly (10).*

- 2) Place the lead pad (12) carefully and centrally on the underside face of the crystal (6), making sure that it does not obscure the input or output angled faces of the crystal. (See Fig 8.)



**Fig 8. ATR Crystal and Lead Pad in the Gateway™ ATR Electrically Heated Trough Top Plate**

- 3) Carefully replace the lower clamp pressure plate (**10**) assembly over the lead pad (**12**) and crystal (**6**) and refit the two screws (**11**). Ensure that the lead pad (**12**) and crystal (**6**) are not dislodged from their central positioning. (See as for **Fig 6** and **Fig 5**.)
- 4) Stand the re-assembled Electrically Heated Trough Top Plate on a tissue covering a work surface and test for leaks. Do not put it onto the optical unit until tested. Test with a suitable solvent or mixture of solvents placed into the trough area to cover the crystal for 30 minutes.

If leaks occur, wipe the Top Plate area with a soft, lint-free tissue and tighten the two screws (**11**) in the lower clamp pressure plate assembly (**10**) by about one sixth of a turn for each screw and re-test.

### **Possible Causes of Leaks**

Assembly not tightened sufficiently.

Lower clamp pressure plate assembly (**10**) and gasket (**8**) seal surfaces not sufficiently cleaned.

Kalrez gasket seal (**8**) is old/worn and requires replacement.

ATR crystal (**6**) is defective (e.g. chipped, dirty, warped).

ATR crystal (**6**) not symmetrically located.

### **Cleaning the Gateway™ ATR Electrically Heated Trough Top Plate Intact**

The procedure for cleaning of the crystal (**6**) with its removal from the Top Plate assembly needs possibly to be carried out only very occasionally. To avoid the need for cleaning the crystal outside of the Top Plate assembly it is important to clean out any sample remaining within the trough sampling area cavity. Clean, distilled water, methanol or acetone are all suitable solvents to moisten a soft lens type cleaning tissue to wipe very carefully against the ATR crystal surface and around the trough top plate area.

Test that the crystal (**6**) is suitably clean by taking a spectral measurement before storage of the Top Plate assembly in a clean, dry cabinet, for example the Specacabinet (P/N GS19100), at about 40°C.

## Notes On Cleaning

When cleaning a ZnSe, Ge or Si crystal (**6**) of the Gateway™ ATR Electrically Heated Trough Top Plate assembly in preparation for a new sample, it is **very important to take care** to avoid damage to the crystal materials. As also mentioned in the Safety Considerations (Section 2, page 5), of the three crystal materials ZnSe is potentially the most hazardous in terms of risk of toxicity if it comes into contact with the skin.



**Note: Always wear gloves to protect yourself and the ATR crystal material.**

A useful feature of the Gateway™ ATR Accessory is the capability for removal of any of the ATR crystal top plate assemblies away from the optical unit, such that any sample can be prepared remotely and safely, if desired, onto the ATR crystal (**6**) surface and then the ATR crystal top plate assembly can be brought for fitting onto the optical unit whilst installed in the spectrometer. Similarly for cleaning, it may be useful to remove any Top Plate assembly from the optical unit and carry it to a safe area for solvent cleaning and wiping with a tissue and therefore minimise any risk of contamination being carried over to other components of the Accessory whilst in situ.

Solvents such as water, methanol and acetone are suitable to use for cleaning purposes. Sample solutions that fall within the pH range of pH5 to pH9 are tolerated by the ZnSe crystal material. Stronger acids and bases will damage ZnSe irreparably. This range is intended as a guide only, please ensure your samples are compatible with your crystal choice

When wiping away any solid or liquid sample residues, use very soft lens tissues to avoid scratches being caused on the surface of the ATR crystals, **particularly if using ZnSe material as this crystal type is not as resilient as germanium or silicon crystals**. Scratches and blemishes to the ATR crystal (**6**) surface will result in poor light throughput for the ATR technique and an overall degradation in the Accessory performance.

## User Manual

In common and general usage of the Gateway™ ATR Electrically Heated Trough Top Plate it may only be necessary to clean with a solvent at the top surface of any Gateway™ ATR crystal (6), between samples.

If possible, try to avoid any solvent or cleaning solution materials from getting to the underside of the Top Plate assembly. There is a risk that any dried solution components that have been introduced to this underside of the Top Plate assembly could be seen as an “impurity” against the ATR crystal in any “background” spectrum to be collected, and so this contaminant would need to be removed before any further sampling can continue.

Removal of such a contaminant may require complete removal of the ATR crystal (6) from the Gateway™ Electrically Heated Trough Top Plate assembly and employment of a suitable cleaning regime.



A full list of EN Safety data sheets for all lens material types are available for download at [www.specac.com](http://www.specac.com)

## Data Sheet For Zinc Selenide

### General

Toxic and hard, yellow coloured crystalline powder when fused together as a solid can be used as a transmission window material or as a crystal material for attenuated total reflectance (ATR) FTIR spectroscopy.

Insoluble in water, but attacked by strong acids and bases. (pH range 5 to 9 tolerant). Organic solvents have no effect.

Fairly brittle as a window material and sensitive to thermal and mechanical shock.

Molecular formula: ZnSe

Chemical Abstracts Service (CAS) No: 1315-09-9.

### Physical Data

Appearance: Yellow crystals, granular powder or amber coloured window material.

Melting point: 1515°C at 1.8 atmospheres. (26.5psi)

Solubility in water: 0g/100g at 0°C.

Hardness: 120 Kg/mm<sup>2</sup>.

Refractive Index: 2.43 (at 2000cm<sup>-1</sup> - wavenumbers).

Spectroscopic transmission range: 20,000 to 500 cm<sup>-1</sup> (wavenumbers).

### Stability

Stable. Reacts with acids to give highly toxic hydrogen selenide. May be air and moisture sensitive. Incompatible with strong acids, strong bases and strong oxidising agents.

### Toxicology



Toxic if small amounts are inhaled or swallowed. In stomach toxic hydrogen selenide (H<sub>2</sub>Se) is liberated. Skin and eye irritant. Danger of cumulative effects from frequent handling without protection.

### Personal Protection

Always wear safety spectacles and gloves when handling the powder or window material. Allow for good ventilation.

### Storage

Keep powder or windows stored in a cool, dry container, with appropriate safety labelling.

## Data Sheet For Germanium

### General

Hard and very brittle material, but can be shaped, cut and polished to form spectral transmission window or crystal for ATR spectroscopy.  
Because of its high Refractive Index value suffers from large reflection losses but these can be improved with antireflection optical coatings  
Is temperature sensitive and loses transmission when heated. (Is optically opaque to IR transmission at 190°C temperature.)  
Insoluble in water and alcohols. Soluble in hot sulphuric acid and aqua regia.  
Element symbol: Ge  
Chemical Abstracts Service (CAS) No: 7440-56-4.

### Physical Data

Appearance: Greyish/black, opaque, elemental, metallic solid. Has no odour.  
Melting point: 737°C.  
Boiling point: 2830°C.  
Vapour pressure:  $2.66 \times 10^{-56}$  mm Hg at 25°C.  
Specific gravity:  $5.323 \text{ g cm}^{-3}$ .  
Solubility in water: Insoluble  
Hardness: 780 Kg/mm<sup>2</sup>.  
Refractive Index: 4.01 (at 2000cm<sup>-1</sup> - wavenumbers).  
Spectroscopic transmission range: 5,500 to 500 cm<sup>-1</sup> (wavenumbers).

### Stability

Stable.

### Toxicology



Harmful if ingested in large amounts, if inhaled, or if in repeated contact with the skin.

### Personal Protection

Always wear safety spectacles and gloves when handling the window or crystal material.  
Allow for adequate ventilation.

### Storage

Keep windows or crystal stored in a cool, dry container.

## Data Sheet For Silicon

### General

Synonyms: Defoamer S-10.

When powder is fused together, is used as a transmission window material. Very hard, but brittle and relatively inert material. Insoluble in water, resists acids and bases but is attacked by combination of hydrofluoric and nitric acid. Can withstand thermal shock.

Useful for Far IR working in the region 400 to 33cm<sup>-1</sup>

Molecular formula: Si.

Chemical Abstracts Service (CAS) No: 7440-21-3

### Physical Data

Appearance: Grey lustrous solid or grey powder.

Melting point: 1410°C.

Boiling point: 2355°C.

Solubility in water: 0g/100g at 0°C.

Hardness: 1150 Kg/mm<sup>2</sup>.

Refractive Index: 3.42 (at 2000cm<sup>-1</sup> - wavenumbers).

Spectroscopic transmission range: 8,333 to 33 cm<sup>-1</sup> (wavenumbers) - not continuous as absorptions in the Mid IR from circa 1300 to 500 cm<sup>-1</sup>.

### Stability



Stable.

Fine powder is highly flammable. Incompatible with oxidizing agents, bases, carbonates, alkali metals, lead and aluminium oxides, halogens, carbides and formic acid.

### Toxicology

Generally regarded as safe.

### Personal Protection

Always wear safety spectacles and gloves when handling the powder or window material. Allow for adequate ventilation.

### Storage

Keep powder or windows stored in a cool, dry container.

## 7. Gateway™ ATR Electrically Heated Trough Top Plate Operating Parameters

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The Gateway™ ATR Electrically Heated Trough Top Plate is provided with its own dedicated 4000 Series™ Temperature Controller. A separate user instruction manual is supplied for specific operation of the 4000 Series™ Temperature Controller.

For operation of the Heated Trough Top Plate the parameters of the 4000 Series™ Temperature Controller have been factory set as shown on the following page. Not all of the displayable parameters can be changed but have been listed for reference purposes. If you ever need to change a parameter or autotune the controller for a particular temperature range certain parameter setting will be altered. You can get back to original factory settings by reprogramming the controller with these original values.

### Specifications

Temperature controller accessory fuse ratings

|             |      |      |         |
|-------------|------|------|---------|
| Voltage     | 230V | 110V | 100V    |
| Frequency   | 50HZ | 60HZ | 50/60HZ |
| Max Power   | 150W | 150W | 150W    |
| Fuse Rating | 1.5A | 3A   | 3A      |
| Fuse Type   | T    | T    | T       |

Insulation rating of external circuits (appropriate for single fault condition) = basic insulation and protective (earth) bonding.

Humidity operation range – 20% to 90% relative humidity non-condensing.

### Displayable Parameters For Gateway™ ATR Electrically Heated Trough Top Plate with WEST 6100+ (4000 Series™) Controllers

| <b>Parameter Display (In Green)</b> | <b>Parameter Name</b>                    | <b>Parameter Factory Set Value</b> |
|-------------------------------------|--|------------------------------------|
| FILt                                | Input Filter Time Constant               | 3.0                                |
| OFFS                                | Process Variable Offset                  | 0                                  |
| PP <sub>L</sub>                     | Primary (Heat) Output Power              | 0                                  |
| Pb_P                                | Primary Output Proportional Band         | 3.9                                |
| ArSt                                | Automatic Reset (Integral Time Constant) | 1.55                               |
| rAtE                                | Rate (Derivative Time Constant)          | 0.28                               |
| biAS                                | Manual Reset (Bias)                      | 25                                 |
| SPuL                                | Setpoint Upper Limit                     | 200                                |
| SPLL                                | Setpoint Lower Limit                     | 0                                  |
| OPuL                                | Primary (Heat) Output Upper Power Limit  | 100                                |
| Ct I                                | Output 1 Cycle Time                      | 4                                  |
| PhAl                                | Process High Alarm                       | 200                                |
| AHyl                                | Alarm 1 Hysteresis                       | 1                                  |
| PLA2                                | Process Low Alarm                        | 0                                  |
| AHy2                                | Alarm 2 Hysteresis                       | 1                                  |
| APt                                 | Auto Pre-Tune enable/disable             | DiSA                               |
| PoEn                                | Manual Control select enable/disable     | DiSA                               |
| SPr                                 | Setpoint Ramping enable/disable          | EnAb                               |
| rP                                  | Setpoint Ramp Rate Value                 | 600                                |
| SP                                  | SP Value                                 | 0                                  |
| Sloc                                | Set-up Lock Code                         | 10                                 |

## *8. Gateway™ ATR Electrically Heated Trough Top Plate “Bubble Number” Part Identification*

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- (1) Round location hole on underside of Heated Trough Top Plate.
- (2) Slot location hole on underside of Heated Trough Top Plate.
- (3) Fixing location pin on top of Gateway™ ATR optical unit.
- (4) Main body plate of Heated Trough Top Plate.
- (5) PTFE stand-off foot on underside of Heated Trough Top Plate.
- (6) ATR crystal.
- (7) PTFE pressure bar.
- (8) Kalrez gasket seal.
- (9) Slot headed spring tensioning screw.
- (10) Lower clamp pressure plate assembly.
- (11) M3 x 8mm cap head screw for lower clamp pressure plate assembly (10).
- (12) Lead pad.

## *9. Gateway™ ATR Electrically Heated Trough Top Plate Spare Parts*

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### **Complete Top Plate Assembly**

P/N GS11155 - Gateway™ ATR Electrically Heated Trough Top Plate with ZnSe crystal, 45° angle and 4000 Series Temperature Controller.

### **Replacement Crystals**

P/N GS11145 - Gateway™ ATR ZnSe crystal, 45° angle.

P/N GS11146 - Gateway™ ATR Silicon crystal, 45° angle.

P/N GS11147 - Gateway™ ATR Germanium crystal, 45° angle.

## 10. Gateway™ ATR Technical Specifications

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|   | <b>ZnSe</b>   | <b>Germanium</b>  | <b>Silicon</b>  |
|---|---|---|---|
| <b>ATR Crystal Active Area</b>                      | ZnSe 45°<br>70mm x 10mm.  | Ge 45°<br>70mm x 10mm.  | Silicon 45°<br>70mm x 10mm  |
| <b>Accessory Transmission Range cm<sup>-1</sup></b> | 7,800 - 550<br>(AR coated)  | 5,500 - 600<br>(AR coated)  | 8,333 - 33<br>(non-continuous)  |
| <b>Refractive Index at 1000cm<sup>-1</sup></b>      | 2.43  | 4.0   | 3.42  |
| <b>Depth of Penetration</b>                         | 2.0µm<br>(For Sample of Refractive index 1.5 @ 1000cm <sup>-1</sup> )                       | 0.7µm<br>(For Sample of Refractive index 1.5 @ 1000cm <sup>-1</sup> )                     | 0.9µm<br>(For Sample of Refractive index 1.5 @ 1000cm <sup>-1</sup> )                     |
| <b>Typical Light Throughput When Aligned</b>        | 20% to 30%<br>Transmission  | 20% to 30%<br>Transmission  | 20% to 30%<br>Transmission  |
| <b>ATR Crystal Plate Assembly</b>                   | ZnSe sealed with Isolast gasket in Trough assembly. Glued with epoxy resin in Flat assembly | Ge sealed with Isolast gasket in Trough assembly. Glued with epoxy resin in Flat assembly | Si sealed with Isolast gasket in Trough assembly. Glued with epoxy resin in Flat assembly |
| <b>Gateway ATR Dimensions W x D X H (mm)</b>        | 160 x 130 x 130   | 160 x 130 x 130   | 160 x 130 x 180   |

## 11. Gateway™ ATR Electrically Heated Trough Top Plate Serial Number

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Your Gateway™ ATR Electrically Heated Trough Top Plate assembly P/N GS11155 will be provided with a serial number for identification of certain individual parts. The serial number is found on a small silver sticker affixed to the underside of the Top Plate assembly.

The same serial number is also printed on the appliance label found at the rear of the Top Plate's dedicated 4000 Series Temperature Controller. (Please also see the user instruction manual for the 4000 Series Controller to register the serial number.)

To help you, please use the grid below to fill in the serial number information of the Gateway™ ATR Electrically Heated Trough Top Plate assembly you have received. If you need to contact Specac for any issues, it may be necessary to provide the serial number of the item to identify for replacement parts.

| <b>Gateway™ ATR Electrically Heated Trough Top Plate Assembly P/N and Description</b>  | <b>Serial Number</b> |
|--|----------------------|
| P/N GS11155 - Gateway™ ATR Electrically Heated Trough Top Plate with ZnSe crystal, 45° angle and 4000 Series Temperature Controller. |                      |

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